Transport and Communications Output and Productivity in Brazil and the USA, 1950-1990

Mulder, Nanno

Transport and Communications Output and Productivity in Brazil and the USA, 1950-90

Research Memorandum 580 (GD-19)

Nanno Mulder

January 1995

Memorandum from
Institute of Economic Research*
Faculty of Economics
University of Groningen
P.O. Box 800
9700 AV Groningen - The Netherlands
tel. 31-50-633741
fax. 31-50-637337

* Research memoranda of the Groningen Growth and Development Centre are published as a sub-series of the memorandum series of the Institute of Economic Research.

Transport and Communications Output and Productivity in Brazil and the USA, 1950-90

Nanno Mulder*
Groningen Growth and Development Centre
University of Groningen
PO Box 800
9700 AV GRONINGEN

January 1995

* I would like to express my gratitude to Angus Maddison for comments on an previous draft of this paper and to Eduardo Pereira Nunes for supplying the Brazilian transport census. This research was supported by the Dutch Foundation for Scientific Research (NWO).

1. Introduction

This paper analyses levels and growth of output and productivity in transport and communications in Brazil and the United States over the years 1950 to 1990. The analysis is similar to that of Mulder (1994b), which adopts a similar approach to compare the situation of Mexico and the United States for the same period[1].

Key characteristics of Brazilian and US transport infrastructure, vehicle stocks, passenger travel, freight transport and energy consumption are presented in Tables 1 to 5. Table 1 shows that the USA had 3.4 times as much railway track per capita as Brazil in 1950, five times as much in 1975 and four times as much in 1990. The table also shows that the number of US kilometres of (paved and unpaved) road per capita was 6 times that of Brazil in 1950, 2.3 times in 1975 and 2.4 times in 1990. The share of paved roads in the total of paved and unpaved roads increased over time in both countries. In 1990, paved roads accounted for 82 per cent of the total in the USA compared to only 10 per cent in Brazil.

Table 2 shows the stock of private automobiles, buses and trucks. In 1950 there were 68 times as many private cars per capita in the USA as in Brazil, 283 times as many trucks and 3 times as many buses. The discrepancy in per capita car ownership narrowed over time, as the figures for 1975 and 1990 indicate, as did the difference in the number of vehicles per head of population.

---

[1] This paper is one of a series of industry-of-origin comparisons between Brazil and the USA comparing levels of output and productivity by sector of the economy. Previous comparisons cover agriculture (Maddison and van Ooststroom, 1993), mining (Maddison and Wieringa, 1985), manufacturing (Maddison and van Ark, 1994) and wholesale and retail trade (Mulder, 1994a). The benchmark year for all these studies was 1975.

Table 1
Transport Infrastructure in Brazil and the USA, 1950, 1975 and 1990

	Brazil		USA	
	Total	Per capita	Total	Per capita
1950:				
Kilometres of railway track	36,681	0.0007	360,137	0.0024
Kilometres of road	302,147 [a]	0.0058	5,330,617 [d]	0.0350
1975:				
Kilometres of railway track	30,809	0.0003	320,000	0.0015
Kilometres of road	1,316,510 [b]	0.0136	6,175,664 [e]	0.0286
1990:				
Kilometres of railway track	30,194	0.0002	231,696	0.0009
Kilometres of road	1,504,041 [c]	0.0100	6,242,920 [f]	0.0245

Sources: 1950 and 1975 Brazil railways from Mitchell (1993), *International Historical Statistics: The Americas 1750-1988*, p.537; 1950 Brazil roads from IBGE (1990), *Estatísticas Históricas do Brasil*, p.465; 1975 Brazil roads from IBGE (1980), *Anuário estatístico do Brasil - 1980*, p. 567 1990 Brazil railways and roads from IBGE (1993), *Anuario Estatístico do Brasil 1992*, p.766-70; 1950 and 1975 USA railways from Mitchell (1993), op. cit. 531-3; 1950 USA roads from US Dept. of Commerce, Bureau of the Census (1975), *Historical Statistics of the United States: Colonial Times to 1970*, part II, p.710; 1975 US railways and roads from from Dept. of Commerce, *The Statistical Abstract of the United States*, 1977; 1990 US figures from *The Statistical Abstract of the United States 1993*, pp. 612 and 630. Population from Maddison (1995), *Monitoring the World Economy*, forthcoming.

[a] Refers to 1952; share of paved roads in the total was 0.7 per cent;
[b] Share of paved roads was 4.5 per cent;
[c] Figure refers to 1991; share of paved roads was 9.6 per cent;
[d] 58.5 per cent of the total were paved roads;
[e] 64.7 per cent of total were paved roads;
[f] 81.9 per cent of these roads were paved.

Table 2
Number of Motor Vehicles in Use, Brazil and the USA, 1950, 1975, and 1990

	Brazil		USA	
	Total (000s)	Per capita	Total (000s)	Per capita
1950:				
Private automobiles	201	0.0039	40,339	0.2649
Trucks	11	0.0002	8,599	0.0565
Buses	26	0.0005	224	0.0015
TOTAL (All motor vehicles)	409	0.0079	49,162	0.3229
1975:				
Private automobiles	3,395	0.0324	106,700	0.4940
Trucks	2,523	0.0241	24,800	0.1148
Buses	84	0.0008	1,400	0.0065
TOTAL (All motor vehicles)	6,080	0.0580	137,864	0.6383
1990:				
Private automobiles	10,598	0.0705	143,550	0.5629
Trucks	2,473	0.0164	53,478	0.2097
Buses			627	0.0025
TOTAL (All motor vehicles)	13,070	0.0869	197,924	0.7761

Sources: Brazil vehicles: 1950 from Mitchell (1993), *op. cit.*, p. 586; 1975 from Ministerio do Transportes (1982), *op. cit.*, p. 382; and 1990 from United Nations (1993), *Statistical Yearbook*, p. 666. USA vehicles: 1950 from US Dept. of Commerce (1975), *op. cit.*, p. 716; 1975 from Dept. of Commerce (1977), *op. cit.*, Table 1002; and 1990 from. Dept. of Commerce, (1993), *op. cit.*, p. 618. Population: see Table 1.

Note: The total is not equal to the sum of the parts, because the total also includes other types of vehicles (like motorcyles).

Table 3 provides an estimate of aggregate passenger travel in 1975. Private cars accounted for over 86 per cent of the total in the USA, compared with only 21 per cent in Brazil. Buses accounted for 75 per cent of passenger travel in Brazil compared with less than 2 per cent in the USA. Car travel is a private non-market activity which does not enter into the national accounts, but we need to keep it in mind in understanding why the proportionate importance of other modes of travel are so different in these countries.

The estimated volume of freight transport by different transport modes and their shares are shown in Table 4. Trucks accounted for 68 per cent of the Brazilian total, but only

for 22 per cent in the USA. Railways were the most important transport mode in the United States, accounting for 37 per cent of the total, and pipelines provided a quarter of US freight transport. The air transport share was very low in both countries (0.2 per cent).

Table 3
Estimated Volume of Domestic Passenger Traffic, Brazil and the USA, 1975

	Brazil		USA	
	Passenger km (billion)	Percent distri-bution	Passenger km (billion)	Percent distri-bution
Private automobiles	60	21.4	1,884	86.5
Airways	5	1.8	238	10.9
Bus	211	75.1	40	1.8
Railways	5	1.7	16	0.7
TOTAL (All modes)	141	100.0	2,179	100.0

Sources: Brazilian passenger movement by airway, bus and railway from Ministerio do Transportes (1982), *Anuário estatístico dos transportes*, p. 445; distance travelled by private cars in Brazil was estimated by multiplying the number of Brazilian cars by the average passenger km per US car; USA from Department of Commerce, *Statistical Abstract of the United States 1993*, Table 1004.

Table 4
Estimated Volume of Domestic Freight Traffic, Brazil and the USA, 1975

	Brazil		USA	
	Tonne-km (billion)	Percent distri-bution	Tonne-km (billion)	Percent distri-bution
Rail	59	19.4	1,111	36.7
Truck	205	67.6	665	22.0
Waterways	32	10.5	501	16.6
Pipeline	7	2.3	742	24.5
Air	1	0.2	6	0.2
TOTAL (All modes)	303	100.0	3,025	100.0

Sources: Brazilian freight transport from Ministerio do Transportes (1982), *Anuário estatístico dos transportes*, p. 446; USA: see Table 3.

Table 5 shows the use of energy in transport in terms of tons of oil equivalent (TOE[2]). Road transport accounted in both countries for 83 per cent of the total energy consumption. The US air transport share in total energy use was twice the Brazilian share. Per capita energy use in the USA was 9 times that of Brazil. Average energy consumption per vehicle was 2.98 TOE in the USA and 3.47 TOE in Brazil. Trucks and buses had a bigger share of the Brazilian vehicle stock (40 per cent compared to 19 per cent in the USA, see Table 2), and the average vehicle in Brazil was older and less efficient.

Table 5
Total Energy Consumption in Transport in Brazil and the USA, 1975 (tons of oil equivalent)

	Brazil		USA	
	Total (000s)	tons per capita	Total (000s)	tons per capita
Railways	580	0.006	13,350	0.062
Road transport	17,540	0.167	336,730	1.559
Air transport	1,293	0.012	51,230	0.237
Domestic water transport	1,689	0.016	6,730	0.031
Total (All modes)	21,102	0.201	408,040	1.889

Sources: Brazil from OECD International Energy Agency (1981), *World Energy Statistics and Balances, 1971/87*, Paris; USA from OECD International Energy Agency (1987), *Energy Balances of OECD Countries, 1970/85*, Paris.

2. Value Added and Employment in Transport and Communications

Value Added

GDP in transport and communications in national currencies is presented in Table 6. GDP was also converted into dollars and cruzeiros using the exchange rate (i.e. 8.13 cruzeiros to 1 US$), see column (2) and (5). Data were drawn from the national accounts.

[2] The total of coal, oil and electricity consumption. These sources of energy were converted to TOE using "coefficients of equivalence".

In Brazil, transport GDP estimates were available only for the sum of road passenger and road freight transport. The fifth item, "transport services" is not separately identified in Brazil, but is included under the rail, road, water and air transport headings. The relative share of each branch in total transport GDP is also shown. Road transport was the most important

Table 6
Gross Value Added in Transport and Communications, Brazil and the USA, in 1975 millions of National Currencies, with Conversion at Exchange Rate

	Brazil			USA		
	GDP at Factor Cost		Percentage share of	GDP at Factor Cost		Percentage share of
	million cruzeiros	million US$[a]	each branch in transport GDP	million US$	million cruzeiros[a]	each branch in transport GDP
	(1)	(2)	(3)	(4)	(5)	(6)
TRANSPORT:						
1. Railways	2,332	287	6.3	12,737	103,552	22.2
2. Road Transport	26,405	3,248	71.8	28,527	231,925	49.8
a) Road Passenger Transport				3,476	28,260	6.1
b) Road Freight Transport				25,051 [b]	203,665 [b]	43.7 [b]
3. Water Transport	4,574	563	12.4	3,969	32,268	6.9
4. Air Transport	3,448	424	9.4	8,978	72,991	15.7
5. Transportation Services				2,884	23,447	5.4
Total (All branches)	36,759	4,521	100.0	57,095	464,182	100.0
COMMUNICATIONS:						
1. Telephone & Telegraph				31,579	256,737	91.1
2. Postal & Other Services				3,085	25,081	8.9
Total (All branches)	9,544	1,174		34,664	281,818	100.0
TOTAL Trans. and Comm.	46,303	5,695		91,759	746,001	
Trans./Comm. share in total GDP	4.41			6.68		

Sources: Brazil from IBGE (1987), *Matriz de relações intersetoriais Brasil - 1975*; USA national accounts value added at factor cost supplied by Robert Parker of the US Department of Commerce.

[a] Conversion with the exchange rate (i.e. 8.13 cruzeiros to 1 US dollar);
[b] Sum of trucking and pipelines;

branch in Brazil and the USA, accounting for 72 per cent and 50 percent of total transport. The second most important branch was water transport in Brazil and rail transport in the USA. The ratio of value added in communications to that in transport was 0.61 in the USA, but only 0.26 in Brazil. The US communications sector is relatively bigger partly because of classification differences. In the USA, radio and television are classified with communications, but not in Brazil (where they are part of cultural services and sport facilities). The bottom line shows the share of transport and communications GDP in total GDP: the US share is more than two percentage points higher than the Brazilian share. Private passenger transport is not regarded as a market activity and is therefore excluded from sectoral output[3].

Employment

Table 7 shows employment in transport and communications derived from the Brazilian and US national accounts. Employment was broken down into two categories: paid employees and proprietors. The Brazilian share of proprietors in total employment was much higher than the US share: 28.0 per cent compared to 7.5 per cent. Most proprietors worked in road transport. Looking at the share of each branch in total transport employment, it can be seen that road transport accounted for over 83 per cent of the total in Brazil compared to 56 per cent in the USA. Rail transport was the second most important employer in both countries.

3. The Comparison of Output and Labour Productivity

Data Sources

The aim of this paper is to analyse levels of labour productivity at the most disaggregated level possible. Labour productivity is defined as value added per person engaged. In order to compare Brazil and the USA, value added needs to be converted into

---

[3] The expenditure per head of population on (private and public) passenger transport in 1975 was 690 cruzeiros in Brazil and 600 US$ in the USA. Private transport expenses accounted for 74.9 per cent of the total in Brazil and 93.3 per cent in the USA. The imputed value of private transport was 55,562 million cruzeiros in Brazil and 120,901 million US$ in the USA (see Kravis, Heston and Summers, 1982, p. 255). Transport GDP was 36,759 million cruzeiros and 57,095 million US$ respectively, e.g. private transport expenditure was 1.5 times in Brazil and 2.1 times in the USA of public transport GDP (including freight transport).

Table 7
Persons Engaged in Transport and Communications, Brazil and the USA, 1975

	Brazil			USA		
	Persons Engaged		Percentage share of	Persons Engaged		Percentage share of
	Total (000s)	of which: proprietors (000s)	each branch in transport employment	Total (000s)	of which: proprietors (000s)	each branch in transport employment
	(1)	(2)	(3)	(4)	(5)	(6)
TRANSPORT:						
1. Railways	136	0	11.1	548	0	19.0
2. Road Transport	1,019	343	83.2	1,624	200	56.3
a) Road Passenger Transport	n.a.	n.a.		307	31	10.6
b) Road Freight Transport	n.a.	n.a.		1,317 [a]	169 [a]	45.6 [a]
3. Water Transport	40	0	3.3	198	3	6.9
4. Air Transport	28	0	2.3	371	5	12.9
5. Transportation Services	n.a.	n.a.		146	9	5.1
Total (All branches)	1,224	343	100.0	2,887	217	100.0
COMMUNICATIONS	153			1,180	2	
TRANSPORT/COMM.	1,378			4,067	219	
Total Engaged (Whole Economy)	37,426			92,853 [b]		
POPULATION	104,851			215,973		

Sources: Brazil from IBGE (1987), *Matriz de relações intersetoriais Brasil - 1975*; total persons engaged and population from A. Maddison and Associates (1992), *The Political Economy of Poverty, Equity and Growth: Brazil and the USA*, OUP, New York, Tables A-2 and A-8; USA from Dept. of Commerce (1992), *The National Income and Product Accounts of the United States, Volume 2, 1959-88*, Washington DC.

[a] Includes pipelines;
[b] Refers to full-time and part-time employees plus self-employed.

a common currency. This was done by using purchasing power parities (PPPs)[4]. In order to calculate PPPs, information is needed on the value of production (receipts or total cost) and the physical quantity produced. The most suitable source for such data on a disaggregated level (and for figures on costs and employment) is the transport census, which is held in both countries every five years. A Brazilian transport census is available for 1975 and a US census for 1977. The Brazilian census gives receipts, costs and

[4] The PPP for a transport service is the ratio the Brazilian producer price or value per unit of transport service divided by the US price or unit value.

employment data in transport establishments, although only at branch level. No data are included on quantities produced by transporters in terms of tonne-km, passenger-km, tonnes or passengers. These had to be derived from other sources[5].

In order to get an impression of the coverage of the transport census, this source was compared with the national accounts, see Table 8. Gross value of output, gross value added (GVA) and employment were compared for 4 branches and the total. Census data did not permit the allocation of transportation services output over the other four

Table 8
Confrontation of Brazilian Census and National Accounts Estimates for Transport, 1975
(million pesos and number of persons engaged)

	Gross Value of Output			Gross Value Added			Persons Engaged		
	Census	National Accounts	Ratio of census to national accounts	Census	National Accounts	Ratio of census to national accounts	Census (000s)	National Accounts (000s)	Ratio of census to national accounts
TRANSPORT:									
1. Railways	1,072	3,804	0.28	595	2,332	0.26	28	136	0.21
2. Road Transport[a]	28,917	53,002	0.55	11.596	26,405	0.44	347	1,019	0.34
a) Road Passenger Transport	11,614			5,761			221		
b) Road Freight Transport	15,768			5,129			108		
3. Water Transport	9,359	13,333	0.70	530	4,574	0.12	13	40	0.33
4. Air Transport	6,387	6,176	1.03	2,133	3,448	0.62	24	28	0.84
5. Transportation Services	7,089			5,777			62		
TOTAL (All branches)	52,824	76,315	0.69	20,630	36,759	0.56	475	1,224	0.39
Labour Productivity[b]									
Rail Transport	100.0	0.74		100.0	0.82				
Road Transport	100.0	0.62		100.0	0.78				
Water Transport	100.0	0.47		100.0	2.85				
Air Transport	100.0	0.81		100.0	1.35				
TOTAL (All branches)	100.0	0.56		100.0	0.69				

Sources: census estimates for all branches except transportation services from IBGE (1981), *Inquérito Especial Sobre Transporte*; transportation services data from IBGE (1981), *Censo dos Serviços*; national accounts estimates from IBGE (1987), *Matriz de relações intersetoriais Brasil - 1975.*

[a] Total is not equal to the sum of the parts, because total includes firms engaged in both passenger and freight transport;
[b] Census value per person engaged is equal to 100.0.

[5] These are IBGE, *Anuário Estatístico do Brasil* (various issues) and Ministerio do Transportes (1982), *Anuário Estatístico dos Transportes.*

branches. The coverage is very different across branches for each of the three variables. Rail transport is surprisingly the branch with the lowest coverage. The highest coverage was obtained for air transport. The census estimate for GVA was 56 per cent the national accounts estimate and the employment estimate was 39 per cent of that of the national accounts. The bottom part of the table shows labour productivity estimated by the census and the national accounts. National accounts value added per person was lower than that of the census for all branches and the total, except for water and air transport. Lower (i.e. national accounts) branch productivity than in the census means that productivity was lower in that part of transport not covered by the census. This is plausible because the characteristics of the "non-recorded" activity (small-scale production, a low capital-labour ratio, low human capital investment, etc.) usually cause its productivity to be lower than in the "registered" sector. Because of the substantial undercoverage of the census, both the census and the national accounts were used for the derivation of productivity.

The US transport census was not adequate for the purpose of this paper mainly because it does not give information by establishment or enterprise on output, costs and employment (see also Mulder, 1994b, p.4). Other sources were used instead[6].

The Brazilian standard industrial classification for transport and communications is presented in Appendix Table A1. The matching of Brazilian and US activities is shown in Appendix Table A2. Appendix Tables A3 and A4 present the basic data listing for Brazil and the USA respectively.

Matching Brazil and the USA: Transport

In order to calculate PPPs we need to measure the value of production and the quantity of transport services produced. The value of production is measured by total receipts, including subsidies and excluding taxes. For a full discussion of the

---

[6] The *Transportation Statistics in the United States* (Department of Transportation, various issues) and *Statistical Abstract of the United States* (Department of Commerce, various issues) were used to derive measures of total receipts and quantities produced. 1975 Estimates of gross value added at factor cost were supplied by Robert Parker of the US Department of Commerce and employment estimates were taken from *The National Income and Product Accounts of the United States, 1959-88* (US Dept. of Commerce, 1992).

measurement of transport output, see Mulder (1994b, pp. 11-5). Physical output in transport consists of two parts: (a) freight or passenger movements over a certain distance ("moving services"), and (b) loading and unloading ("terminal") services. The first can be measured in numbers of tonne-kilometres or passenger-kilometres, and the second by the amount of tonnes of freight or number of passengers loaded or unloaded, see Table 9. This table also shows the gross value of output (GVO) for each mode of transport.

Table 9
Moving and Terminal Services for Freight and Passengers, Brazil and the USA, 1975

	Quantities Produced (million)						Gross Value of Output	
	Moving services (tonne km or passenger km)			Terminal Services (tonnes or passengers)				
	USA	Brazil	USA/ Brazil	USA	Brazil	USA/ Brazil	USA (million US$)	Brazil (million cruzeiros)
Passenger transport:								
- rail	15,985	10,621	1.5	269	292	0.9	297	395
- bus	n.a.	n.a.		5,435	11,455	0.5	2,610	11,340
- subway	n.a.	n.a.		1,673	22	77.0	517	n.a.
- air: domestic	211,905	5,106	41.5	189	6	30.8	10,290	3,724
international	50,040	5,276	9.5	16	1	11.9	2,435	1,178
Freight transport:								
- rail	1,093,446	58,933	18.6	1,270	126	10.1	15,390	3,302
- road[a]	664,742	42,618	15.6	1,271	124	10.2	47,400	13,641
- water:								
- rivers/lakes	364,460	n.a.		645	3	241.7	2,157	146
- ocean/coastwise	n.a.	31,740		964	17	57.5	6,590	1,154
- air: domestic	5,022	521	9.6	n.a.	n.a.		949	419
international	3,624	847	4.3	n.a.	n.a.		478	429

Sources: Appendix Tables A3 and A4.

[a] The number of tons transported was estimated by dividing the number of tonne km (column 2 and 3), by the average length of haul (see Table 10).

US relative output (Q^{USA}) was estimated by a composite index, in which Brazilian output (Q^{Br}) was set equal to 100. This composite index is the weighted average of i) the relative amount of US freight or passenger moving services compared to Brazil, and ii) the relative amount of US terminal services compared to Brazil, see formula (1). M^{USA} and M^{Br} represent the movement of freight or passengers in the USA and in

Brazil respectively measured by the number of tonne km or passenger km. T^{USA} and T^{Br} represent terminal services in the USA and in Brazil respectively measured by the amount of tonnes of freight or number of passengers loaded or unloaded. The weights are (1-α) for moving services (i.e. M^{USA}/M^{Br}) and α for the terminal services (i.e. T^{USA}/T^{Br}). The weight α is between 0 and 1.

$$Q^{USA} = [(1-\alpha)\frac{M^{USA}}{M^{Br}} + \alpha\frac{T^{USA}}{T^{Br}}] * 100; \quad Q^{Br} = 100 \qquad (1)$$

The share α is determined by the difference between the Brazilian and the US average freight haul or passenger trip, see formula (2a) and (2b). H^{USA} and H^{Br} represent the average distance over which freight or passengers were transported in 1975 in the USA and in Brazil respectively (see Table 10). The bigger the difference between H^{USA} and H^{Br}, the higher α will be (i.e. the bigger the weight of terminal services in the composite index).

$$\alpha = (1 - \frac{H^{Br}}{H^{USA}}) \; if \; H^{Br} < H^{USA} \qquad (2a)$$

or

$$\alpha = (1 - \frac{H^{USA}}{H^{Br}}) \; if \; H^{Br} > H^{USA} \qquad (2b)$$

Where possible physical output was adjusted in order to take account of terminal services using formulae (1) to (3), and to take account of quality differences:

a) *Rail freight and rail passenger transport*: a weighted average was taken of the quantity ratios for moving and terminal services. A quality adjustment was made in the case of rail passenger transport. One of the aspects of quality is crowdedness of trains. Brazilian trains carried on average 1.65 times as many passengers as US trains. The Brazilian weighted quantity ratio of rail passenger transport was adjusted for the lower quality by the ratio of US to Brazilian passenger km per wagon. It was assumed that other quality characteristics were also covered by the crowdedness indicator.

Table 10
Length of Average Passenger Trip and Average Freight Haul
USA and Brazil, 1975

	USA	Brazil	USA/ Brazil	α
	(1)	(2)	(3)	(4)
Passenger transport:				
- rail	59	36	1.63	0.39
- bus transport	n.a.	n.a.		
- subway	n.a.	n.a.		
- air: domestic	1,121	831	1.35	0.26
international	3,127	3,914	0.80	0.20
Freight transport:				
- rail	861	469	1.84	0.46
- road[a]	523	343	1.52	0.34
- water:				
- rivers and lakes	565	n.a.		
- ocean and coastwise[b]	2,191	1,894		
- air: domestic	n.a.	n.a.		
international	n.a.	n.a.		

Source: Tables 8.

Note: α is the weight of terminal services in the composite index of US relative transport output, see text.

[a] The Brazilian average length of freight haul was assumed to be equal to the Mexican, as derived from Dept. of Transportation (1994), *North American Transportation*, pp. 48 and 50 (estimates refer to 1987);
[b] Coastwise only.

b) *Road passenger transport*: No data were available on the average passenger trip length. No adjustment could therefore be made for the different proportion of terminal services in total transport output. Brazilian output was adjusted for the lower quality of service (overcrowding) by using the ratio of the US to the Brazilian number of passengers transported per bus in 1975. It was assumed that this adjustment also takes accounts of other quality differences. Estimates were only available for 1974 and 1976. Physical output in 1975 was taken to be the average of the 1974 and 1976 figures. Revenue for 1975 was the average of these two years. 1974 and 1976 were adjusted to 1975 prices using the deflator for total GDP;

c) *Road freight transport*: output was measured by a weighted average of moving and terminal services. Brazilian data were only for 1974 and 1976. 1975 physical output and revenue were estimated as for road passenger transport;

d) *Water transport*: output was measured by tons of freight transported. It was assumed that the average freight haul was similar for Brazil and the USA, which means that the number of tons transported is good proxy for total output.

e) *Air transport*: an adjustment for the different proportion of terminal services was made only for air passenger transport. Average freight haul data were not available. Brazilian air transport has a lower service level than the USA, i.e. more delays, older aeroplanes, etc. I assumed that the Brazilian service level was 70 per cent of the USA, and adjusted Brazilian output correspondingly;

Matching Brazil and the USA: Communications

Matches were made for telephone services (number of telephones was used as the output measure), telegraph services (messages transmitted) and postal services (items of mail handled), see Table 11.

Table 11
Communications in Brazil and the USA, 1975

	USA		Brazil	
	Total (million)	Per capita	Total (million)	Per capita
Number of telephones	130	0.602	3	0.033
Number of calls	228,917	1,060	6,093	58[a]
Pieces of domestic mail sent	88,334	409	1,246	12

Sources: Appendix Tables A3 and A4.

[a] Estimated by multiplying the number of telephones by the average US number of calls per telephone.

4. Aggregate Results in Terms of Output, PPPs and Labour Productivity

The physical output measure was discussed above. Dividing revenue by physical output provides an estimate of unit costs (for example pesos or US$ per passenger km or ton km). The ratio of the Brazilian unit value to US unit value is defined as the purchasing power parity (PPP)[7]. If a PPP is to be calculated for a combination of transport activities, the PPPs for specific transport activities have to be weighted. Either Brazilian or US quantities produced can be used as weights. If the former set of weights is used, a Paasche PPP is derived and if US weights are used we get a Laspeyres PPP. The geometric average of both is the Fisher PPP. This aggregation procedure was applied in moving from a specific transport activity to the branch level. The second step of aggregation from branch to sector level was made by weighting the PPPs for the gross value of output as derived for each branch by the value added in Mexico or the USA as listed in Table 6.

The Paasche, Laspeyres and Fisher PPPs by branches and for total transport and communications are shown in Table 12. No PPPs could be derived for transport and communication services. The PPPs for transport and communication services were assumed to be equal to the weighted average of the PPPs for the other branches, using gross value added as the weight. Low PPPs were observed for railways, road passenger, road freight transport and telegraph services. High PPPs were found for air and water transport, and telephone services. The Paasche PPP for total transport was 4.06 cruzeiros per US$ and the Laspeyres PPP was 5.99. The PPPs for total communications were much higher, i.e. 10.11 and 10.66 respectively.

Our PPPs derived by the industry-of-origin approach (Table 12) were compared with those of the International Comparisons Project (ICP) expenditure approach (Table 13). Freight transport is an intermediate service and is therefore excluded from ICP. ICOP PPPs were much higher for all services, indicating that the Brazilian relative consumer price was much lower than the cost of these services, due to the large degree of subsidisation of these services.

---

[7] The USA was the "numéraire" country.

Table 12
Paasche, Laspeyres and Fisher PPPs for Transport and Communications, Brazil and the USA, 1975

	With Brazilian quantity weights (Paasche PPPs)	With US quantity weights (Laspeyres PPPs)	Geometric average (Fisher)
TRANSPORT:			
1. Railways	3.24	3.20	3.22
2. Road Transport	3.50	3.91	3.70
a) Road Passenger Transport	3.07	3.07	3.07
b) Road Freight Transport	3.96	3.96	3.96
3. Water Transport	10.53	11.62	11.06
4. Air Transport	10.14	16.15	12.80
5. Transportation Services	4.06	5.99	4.93
Total (All branches)	4.06	5.99	4.93
COMMUNICATIONS:			
1. Telephone Services	11.25	11.25	11.25
2. Postal Services	9.09	9.09	9.09
3. Telegraph Services	2.44	2.44	2.44
4. Other Communication Services	10.11	10.66	10.38
Total (All branches)	10.11	10.66	10.38
TRANSPORT/COMMUNICATIONS	4.52	9.14	6.43
Exchange rate	8.13	8.13	8.13

Sources: Appendix Table A5.

Notes: The Paasche and Laspeyres PPPs for total transport and communications were obtained by weighting the PPPs of separate branches. National accounts gross value added was used as weight.

PPPs for transportation and communication services were assumed to be the same as the average for the other branches.

Table 13
Comparison of ICP and ICOP: ICOP Fisher PPPs and Detailed Binary PPPs in Transport and Communications, Brazil and the USA, 1975 (cruzeiros per US$)

	ICOP Fisher estimate	ICP detailed binary
Transport:		
1. Rail Passenger Transport	3.61	1.33
2. Road Passenger Transport	3.07	1.31
3. Air Passenger Transport	12.80	4.22
Communications:		
1. Telephone, Telegraph Services	11.25	0.74
2. Postal Services	9.09	8.65

Sources: ICOP Fisher estimates are the geometric average of the Paasche and Laspeyres estimates of Table A5. Unpublished ICP detailed binary PPPs supplied by Alan Heston (worksheets from Kravis, Heston and Summers, 1982).

GDP per head of population is shown in Table 14. Gross value added was converted by the PPP converters of Table 12 and the exchange rate. Brazilian GDP per capita was almost half of the US level for road transport (Fisher result). The lowest relative GDP per capita levels for Brazil were found in air transport and communications. Brazilian per capita GDP for total transport and communications was 12 per cent of the US level.

Table 14
Gross Value Added in Transport and Communications per Head of Population, Brazil and the USA, 1975

	Using ICOP PPPs Converters			Exchange rate conversion
	At Brazilian "prices"	At US "prices"	Geometric average	
	(1)	(2)	(3)	(4)
TRANSPORT:				
1. Railways	11.8	11.7	11.7	4.6
2. Road Transport	49.5	54.5	52.0	23.5
3. Water Transport	20.4	22.5	21.5	29.2
4. Air Transport	4.9	7.8	6.2	9.7
Total (All branches)	21.1	32.6	26.2	16.3
COMMUNICATIONS	4.2	4.4	4.3	5.4
TRANSPORT/COMM.	10.9	22.0	15.4	12.2

Sources: Gross value added from Table 6, Population from Table 7 and Paasche and Laspeyres PPPs from Table 12.

Labour Productivity: 1975 Benchmark

Labour productivity in national currencies is shown in Table 15. The Brazilian estimates were drawn from the census. Column (2) and (4) show the ratio of branch labour productivity to the average productivity. Labour productivity varies much more across branches in Brazil than in the USA (the ratio of the lowest to the highest gross value added per person engaged was 2.1 for the USA and 4.3 for Brazil). Low productivity was found in rail transport in Brazil and in road passenger transport in the USA. The highest relative productivity was found in air transport in both countries. The final column shows Brazilian productivity as a percent of the US level, converting Brazilian GVA per person by the exchange rate. Low relative productivity was found in rail transport and communications.

Table 15
Gross Value Added per Person Engaged (in National Currencies) in Transport and Communications, Brazil and the USA, 1975

	Brazilian gross value added per person engaged (1975 pesos)[a]	Brazilian gross value per person engaged as as % of the average	US gross value added per person engaged (1975 US$)	Brazilian gross value per person engaged as as % of the average	Brazilian value added per person engaged (converted at the exchange rate) as a % of US productivity
TRANSPORT:					
1. Railways	20,961	48.2	23,243	117.5	11.1
2. Road Passenger Transport	26,108	60.1	11,322	57.3	28.4
3. Road Freight Transport	47,535	109.4	19,021	96.2	30.7
4. Water Transport	39,707	91.4	20,045	101.4	24.4
5. Air Transport	89,908	206.9	24,199	122.4	45.7
6. Transportation Services	93,456	215.0	19,753	99.9	58.2
Total (All branches)	43,465	100.0	19,777	100.0	27.0
COMMUNICATIONS	48,567		29,376		20.3
TRANSPORT/COMM.	44,712		22,562		24.4

Sources: Brazilian gross value added and employment data from Table 8. US GDP data from Table 6 and employment from Table 7.

[a] Census estimates, except for communications.

Table 16 and 17 show value added per person engaged, using ICOP Paasche and Laspeyres converters. Table 16 shows the results using Brazilian census estimates of value added per person and Table 17 shows results using Brazilian national accounts estimates. Table 16 shows high Brazilian relative productivity in road freight transport and transportation services and a low relative performance in railways and communications. Table 17 shows higher Brazilian relative productivity in water and air transport. Brazilian GDP per person in total transport and communications was 31 per

Table 16
Gross Value Added per Person Engaged in Transport and Communications Using Brazilian Census Data, Converted with ICOP PPPs, Brazil and the USA, 1975

	at Brazilian "Prices"[a]			at US "Prices"[b]			Fisher Geometric average[c]
	Brazil	USA	Brazil/ USA	Brazil	USA	Brazil/ USA	
	(million cruzeiros)		(%)	(million US$)		(%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRANSPORT:							
1. Railways	20,961	74,476	28.1	6,478	23,243	27.9	28.0
2. Road Passenger Transport	26,108	34,730	75.2	8,512	11,322	75.2	75.2
3. Road Freight Transport	47,535	75,271	63.2	12,012	19,021	63.2	63.2
4. Water Transport	39,707	233,019	17.0	3,771	20,045	18.8	17.9
5. Air Transport	89,908	390,930	23.0	8,869	24,199	36.7	29.0
6. Transportation Services	93,456	118,247	79.0	23,000	19,753	116.4	95.9
Total (All branches)	43,465	124,366	34.9	10,697	19,777	54.1	43.5
COMMUNICATIONS	48,567	313,193	15.5	4,803	29,376	16.3	15.9
TRANSPORT/COMM.	44,712	206,148	21.7	9,894	22,562	43.9	30.8

Sources: Brazilian census data from Table 8; US GDP and employment from Table 6 and 7; Paasche and Laspeyres PPPs from Table 12.

[a] US gross value added converted to cruzeiros with Laspeyres PPPs;
[b] Brazilian gross value added converted to US$ with Paasche PPPs.

cent of the US level using Brazilian census estimates and 22 per cent using national accounts estimates of GDP and employment. I prefer the latter result, because of the wider coverage of transport activities of the national accounts compared to the census. In Table 8 we saw that the census overestimated productivity for the total sector. Mexican relative labour productivity was higher than that of Brazil, i.e. transport labour productivity was 35 per cent of the US level in 1975, communications performance was 43 per cent and total transport and communications productivity was 34 per cent (Mulder, 1994b, p. 27).

Table 17
Gross Value Added per Person Engaged in Transport and Communications Using Brazilian National Accounts Data, Converted with ICOP PPPs, Brazil and the USA, 1975

	at Brazilian "Prices"[a]			at US "Prices"[b]			Fisher Geometric average[c]
	Brazil	USA	Brazil/ USA	Brazil	USA	Brazil/ USA	
	(million cruzeiros)		(%)	(million US$)		(%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TRANSPORT:							
1. Railways	17,099	74,476	23.0	5,284	23,243	22.7	22.8
2. Road Freight Transport	25,909	67,607	38.3	7,409	17,566	42.2	40.2
3. Water Transport	113,042	233,019	48.5	10,734	20,045	53.3	51.0
4. Air Transport	121,391	390,930	31.1	11,975	24,199	49.5	39.2
Total (All branches)	30,022	124,366	24.1	7,388	19,777	37.4	30.0
COMMUNICATIONS	48,567	313,193	15.5	4,803	29,376	16.3	15.9
TRANSPORT/COMM.	32,088	206,148	15.6	7,100	22,562	31.5	22.1

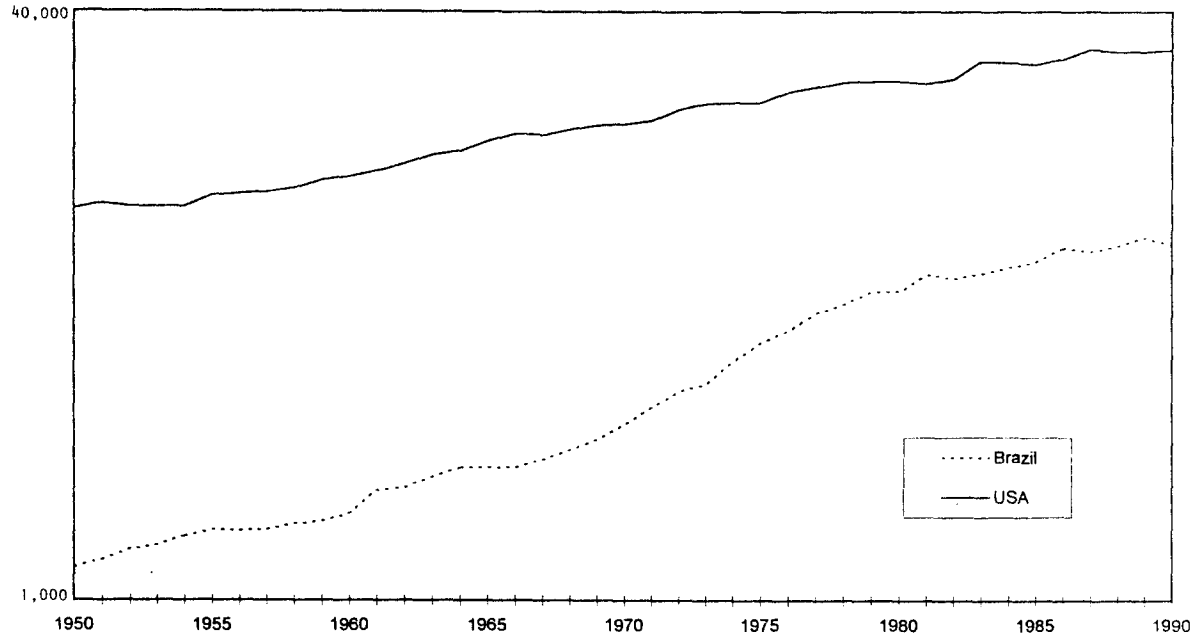
Sources: Brazilian and US GDP from Table 6; employment from Table 7 and Paasche and Laspeyres PPPs from Table 12.

[a] US gross value added converted to cruzeiros with Laspeyres PPPs;
[b] Brazilian gross value added converted to US$ with Paasche PPPs.

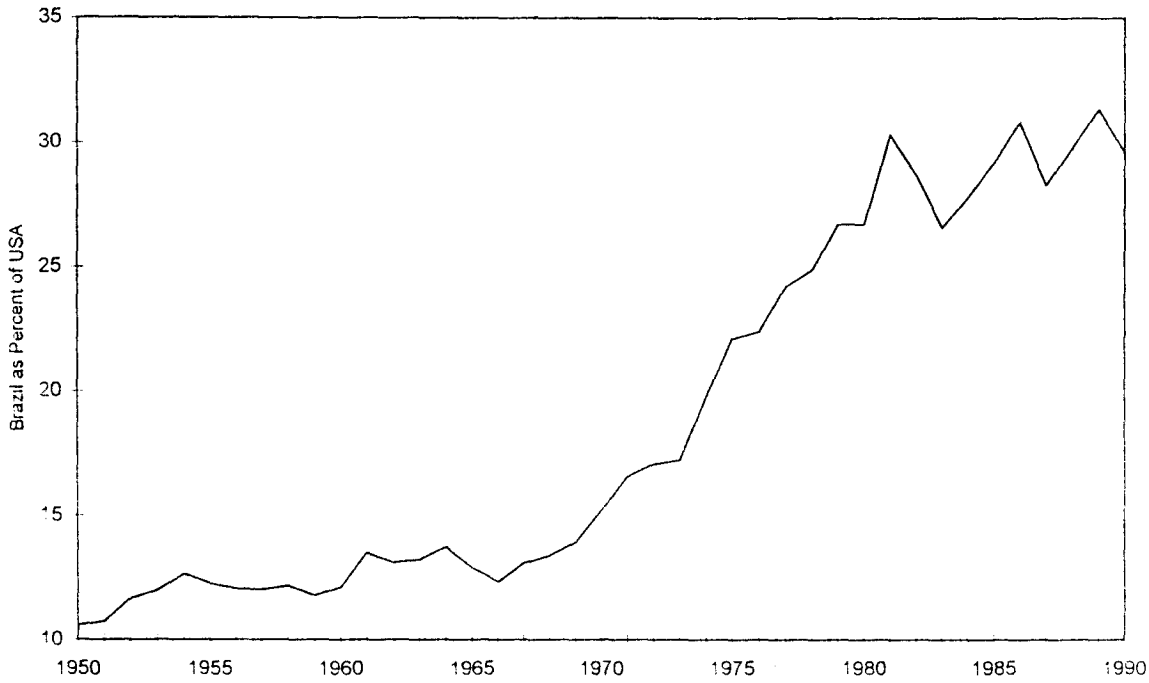
Changes in Labour Productivity, 1950-90

The 1975 benchmark result was extrapolated to cover the 1950-90 period using series of GDP in constant prices and employment (See Appendix A6 and A7). Graph 1 shows GDP per person engaged in 1975 US$ on a semi-logarithmic scale. Brazilian GDP per person was converted using the ICOP Fisher PPP. Brazilian and US GDP per person show an upward trend during the entire postwar period. Graph 2 shows Brazilian labour productivity as a percentage of the USA. Brazilian relative productivity was rather stagnant until 1966, after which the relative performance improved very fast until 1980. In the 1980s relative productivity fluctuated. Brazilian relative productivity in 1990 was 30 per cent of the US level.

Graph 1
GDP per Person Engaged in Transport and Communications in 1975 US$, Brazil and the USA, 1950-90 (semi-logarithmic scale)



Graph 2
Brazilian Labour Productivity as Percent of the USA, Transport and Commmunications, 1950-90



References

Castro, N. de (1988), "Estrutura e desempenho do setor transporte rodoviário de carga", *Pesquisa e Planejamento Economico*, Vol. 18, N° 1, pp. 55-82.

Kravis, I.B., A. Heston and R. Summers (1982), *World Product and Income: International Comparisons of Real Gross Product*, Johns Hopkins University Press, Baltimore.

Maddison, A. and Associates (1992), *The Political Economy of Poverty, Equity and Growth: Brazil and Mexico*, OUP, New York.

--- and P. Wierenga (1985), "An International Comparison of Levels of Real Output in Mining and Quarrying in 1975", mimeographed, University of Groningen.

--- and B. van Ark (1989), "An International Comparison of Purchasing Power, Real Out put and Labour Productivity: A Case Study for Brazilian, Mexican and US Manufacturing, 1975", *Review of Income and Wealth*, Series 53, No. 1, pp. 31-55.

--- and H. van Ooststroom (1993), "The International Comparison of Value Added, Productivity and Purchasing Power Parities in Agriculture", *Research Memorandum 536 (GD-1)*, Groningen Growth and Development Centre, University of Groningen.

Ministerio dos Transportes (1974), *Visão histórica e análise conceitual dos tansportes no Brasil*, Rio de Janeiro.

--- (1977), *Os transportes no atual desenvolvimento do Brasil*, Rio de Janeiro.

Mulder, N. (1994a), "Output and Productivity in Brazilian Distribution: A Comparative View", *Research Memorandum 578 (GD-17)*, Groningen Growth and Development Centre, Groningen.

--- (1994b), "Transport and Communications in Mexico and the United States: Value Added, Purchasing Power Parities and Labour Productivity, 1950-87", *Research Memorandum 579 (GD-18)*, Groningen Growth and Development Centre, University of Groningen.

Wright, C.L. (1987), "Transport in Brasilia: The Limits of Aesthestics", *Transport Reviews*, Vol. 7, No. 4. pp. 281-305.

Statistical Sources:

Brazil:

Fundação Instituto Brasileiro de Geografia e Estatística (IBGE) (1981), *Inquérito Especial Transporte*, Rio de Janeiro.

--- (1981), *Censo dos Serviços*, Rio de Janeiro.

--- (1987), *Matriz de Relaçoes Intersetoriais - 1975*, Rio de Janeiro.

--- (1990), *Estatísticas Históricas do Brasil*, 2nd edition, Rio de Janeiro.

--- (1992), *Contas Consolidadas para a Nação Brasil, 1980-1991*, Rio de Janeiro.

--- (1994), *Listagem do Cadastro de Atividades Economicas*, Rio de Janeiro.

---, *Pesquisa Nacional por Amostra de Domicílios* (PNAD), various issues, Rio de Janeiro.

---, *Anuário Estatístico do Brasil*, various issues, Rio de Janeiro.

Ministerio do Transportes (1982), *Anuário Estatístico dos Transportes*, Rio de Janeiro.

USA:

Bureau of Labor Statistics (1982), *Labor Force Statistics Derived from the Current Population Survey: A Databook*, Washington DC.

Department of Commerce, *Statistical Abstract of the United States*, Washington DC, various issues.

---, Bureau of the Census (1981), *1977 Census of Transportation*, Washington DC.

--- (1987), *The National Income and Product Accounts of the United States, 1929-82*, Wahsington DC.

--- (1992), *The National Income and Product Accounts of the United States, Volume 2, 1959-88*, Washington DC.

Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics*, Washington DC, various issues.

--- (1994), *North American Transportation: Statistics on Canadian, Mexican & United States Transportation*, Washington DC.

Executive Office of the President (1972), *Standard Industrial Classification*, Washington DC.

APPENDIX A

(available upon request from the author)

Table A1 : Brazilian Standard Industrial Classification and Glossary for Transport and Communications;

Table A2 : Matching Procedures for Transport and Communications, Brazil and the USA, 1975;

Table A3 : Basic Brazilian Listing for Transport and Communications, Brazil, 1975;

Table A4 : Basic US Listing for Transport and Communications, USA, 1975;

Table A5 : Matching of Product Items, USA and Brazil, Transport and Communications, 1975;

Table A6 : GDP at Constant Prices in Transport and Communications, Brazil and the USA, 1950-90

Table A7 : Employment in Transport and Communications, Brazil and the USA, 1950 - 90

Papers issued in the sub-series of the Groningen Growth and Development Centre:

536 (GD-1) Maddison, Angus and Harry van Ooststroom, The International Comparison of Value Added, Productivity and Purchasing Power Parities in Agriculture (1993)

537 (GD-2) Mulder, Nanno and Angus Maddison, The International Comparison of Performance in Distribution: Value Added, Labour Productivity and PPPs in Mexican and US Wholesale and Retail Trade 1975/7 (1993)

538 (GD-3) Szirmai, Adam, Comparative Performance in Indonesian Manufacturing, 1975-90 (1993)

549 (GD-4) de Jong, Herman J., Prices, Real Value Added and Productivity in Dutch Manufacturing, 1921-1960 (1993)

550 (GD-5) Beintema, Nienke and Bart van Ark, Comparative Productivity in East and West German Manufacturing before Reunification (1993)

567 (GD-6) Maddison, Angus and Bart van Ark, The International Comparison of Real Product and Productivity (1994)

568 (GD-7) de Jong, Gjalt, An International Comparison of Real Output and Labour Productivity in Manufacturing in Ecuador and the United States, 1980 (1994)

569 (GD-8) van Ark, Bart and Angus Maddison, An International Comparison of Real Output, Purchasing Power and Labour Productivity in Manufacturing Industries: Brazil, Mexico and the USA in 1975 (1994) (second edition)

570 (GD-9) Maddison, Angus, Standardised Estimates of Fixed Capital Stock: A Six Country Comparison (1994)

571 (GD-10) van Ark, Bart and Remco D.J. Kouwenhoven, Productivity in French Manufacturing: An International Comparative Perspective (1994)

572 (GD-11) Gersbach, Hans and Bart van Ark, Micro Foundations for International Productivity Comparisons (1994)

573 (GD-12) Albers, Ronald, Adrian Clemens and Peter Groote, Can Growth Theory Contribute to Our Understanding of Nineteenth Century Economic Dynamics (1994)

574 (GD-13) de Jong, Herman J. and Ronald Albers, Industrial Output and Labour Productivity in the Netherlands, 1913-1929: Some Neglected Issues (1994)

575 (GD-14) Mulder, Nanno, New Perspectives on Service Output and Productivity: A Comparison of French and US Productivity in Transport, Communications Wholesale and Retail Trade (1994)

576 (GD-15) Maddison, Angus, Economic Growth and Standards of Living in the Twentieth Century (1994)

577 (GD-16) Gales, Ben, In Foreign Parts: Free-Standing Companies in the Netherlands around the First World War (1994)

578 (GD-17) Mulder, Nanno, Output and Productivity in Brazilian Distribution: A Comparative View (1994)

579 (GD-18) Mulder, Nanno, Transport and Communication in Mexico and the United States: Value Added, Purchasing Power Parities and Productivity (1994)

580 (GD-19) Mulder, Nanno, Transport and Communications Output and Productivity in Brazil and the USA, 1950-1990 (1995)

Appendix Table A1
Brazilian Standard Industrial Classification and Glossary for Transport and Communications

SIC code	Portuguese	English	SIC code
60	TRANSPORTE TERRESTRE	LAND TRANSPORT	621
601	Transporte Ferroviario	Rail transport	
	6011 Transporte ferroviario de passageiros	Rail passenger transport	
	6012 Outros transportes ferroviarios	Other rail transport	
602	Outros Transportes Terrestres	Other Land Transport	622
	6021 Transporte Metroviario	Subway	
	6022 Transporte rodoviario de passageiros, regular, urbano	Scheduled urban road passenger transport	
	6023 Transporte rodoviario de passageiros, regular, nao urba	Scheduled rural road passenger transport	
	6024 Transporte rodoviario de passageiros, nao regular	Non-scheduled road passenger transport	63
	Nota: esta clase compreende os servicos de taxis, de locacao de veiculos com motoristas, de fretamento de veiculos para excurcoes ou transporte de empregados o servico de ambulancia		631
	6025 Transporte rodoviario de cargas, em geral	Road freight transport, general type of goods	
	Nota: esta clase compreende todos os tipos de transporte de carga, regular ou nao, inclusive o transporte em veiculos de tracao animal ou humana. Compreende tambem a locacao de caminhoes com motorista. Nao compreende o transporte de valores (7492) e de mudancas (6027)		
	6026 Transporte rodoviario de cargas perigosas	Road transport of dangerous materials	
	6027 Transporte rodoviario de mudancas	Road transport of household goods (removals)	
	6028 Transporte regular em bondes, funiculares, telefericos trens proprios para exploracao de pontos turisticos	Miscellaneous passenger transport: streetcars, cable cars and trains used for touristic purposes	
603	Transporte por Tubulacoes ou Dutos	Pipelines	632
	6030 Transporte por tubulacoes ou dutos	Pipelines	
	Nota: compreende o transporte por tubulacoes ou dutos de gases, liquidos, graos, minerios, etc.,. Exclusive os servicos de utilidade publica de distribucao de agua		
61	Transporte Aquaviario	Water transport	
611	Transporte Maritimo	Sea and coastal transport	
	6111 Transporte maritimo de cabotagem	Coastal transport	
	6112 Transporte maritimo de longo curso	Deep sea transport	
612	Outros Transportes Aquaviarios	Other types of water transport	
	6121 Transporte por navegacao interior	Inland water transport	
	6122 Transporte aquaviario urbano e outros	Urban and other types of water transport	
62	Transporte Aereo	Air transport	
	Nota: excluem-se desta categoria as atividades de manutencao de aeronaves e seus motores		

Appendix Table A1 (cont.)
Brazilian Standard Industrial Classification and Glossary for Transport and Communications

SIC code	Portuguese	English
621	Transporte Aereo, Regular	Scheduled air transport
6210	Transporte aereo, regular	Scheduled air transport
	Nota: compreende o transporte regular, de passageiros e cargas em linhas domesticas e internacionais	
622	Transporte Aereo, Nao Regular	Non-scheduled air transport
6220	Transporte aereo, nao regular	Non-scheduled air transport
	Nota: compreende o transporte nao regular, de passageiros e cargas como voos fretados, servicos de taxi aereo e etc.; assim como o transporte especial	
63	Atividades Anexas e Auxiliares aos Transportes e Agenci viagem	Transport services and travel agencies
631	Movimentacao e Armazenamento de Cargas	Loading/unloading services and warehousing
6311	Carga e descarga	Loading and unloading
	Nota: esta clase compreende os servicos de carga e descarga, por manuseio ou nao de de mercadorias e equipamentos, independente do meio de transporte utilizado. Compreende tambem os servicos de estiva e desestiva	
6312	Armazenamento e depositos de cargas	Warehousing
	Nota: esta clase compreende os servicos de armazenamento e depositos de cargas (camaras frigorificadas, guarda-moveis, armazens gerais, depositos para armazenamento de gas e petroleo, etc.)	
	Nao compreende os servicos de garagem e parques de estacionamento para veiculos automotores (6321)	
632	Atividades Axiliares aos Transportes	Miscellaneous transport services
6321	Atividades axiliares aos transportes terrestres	Services incidental to land transport
	Nota: esta clase compreende as atividades de operacao de terminais rodoviarios e ferroviarios; cobranca de pedagios em rodovias; os parques de estacionamento e as garagens para veiculos. Remonta de cargas e etc. Compreende tambem os servicos de guarda-volumes e o translado de passageiros	
6322	Atividades axiliares aos transportes aquaviarios	Services incidental to water transport
	Nota: Esta clase compreende as atividades de operacao de portos, centros de controle de navegacao, pilotagem e praticagem em estuarios e portos. Eclusas e rebocagem, salvamento de embarcacoes e cargas, vistoria de embarcacoes, limpeza de cascos e servicos de escafandria e mergulho, etc. Compreende tambem os servicos de guarda-volumes e o translado de passageiros	

Appendix Table A1 (cont.)
Brazilian Standard Industrial Classification and Glossary for Transport and Communications

SIC code	Portuguese	English
	6323 Atividades axiliares aos transportes aereos	Services incidental to air transport
	Nota: Esta clase compreende as atividades de operacao de aeroportos, campos de aterrissagem, instalacoes para navegacao aerea (radiofarois, centro de controle de voo, estacoes de radar, limpeza de aeronaves, etc.) e etc. Compreende tambem as atividades de guarda-volumes e o translado de passageiros	
633	Agencias de Viagem e de Turismo	Travel agencies
	6330 Agencias de viagem e de turismo	Travel agencies
	Nota: esta categoria compreende tambem as agencias de venda de passagens de empresas de transportes com sede no exterior e as agencias autonomas - nao vinculados as empresas de transportes; assim como os servicos de guias turisticos	
634	Atividades de Outras Agencias de Transportes	Miscellaneous transport services
	6340 Atividades de outras agencias de transportes	Miscellaneous transport services
	Nota: esta clase compreende os servicos de despachantes e o agenciamento de cargas de organizacao ou coordenacao do transporte em nome do expedidor ou consignatario; os servicos de comissaria; a agrupacao e o fracionamento de cargas; a contratacao de espaco para embarques em aeronaves e navios; a contratacao de fretes; a tramitacao das formalidades de aduana; a inspecao de cargas, etc. Nao compreende as atividades relacionadas com o seguro de cargas (6720)	
64	Correio e Telecomunicacoes	Postal services and telecommunications
641	Correio	Postal services
	6411 Atividades de Correio Nacional	National postal services
	Nota: esta categoria compreende a coleta, o transporte e a entrega de correspondencia (nacional e internacional); venda de selos postais; coleta de correspondencia e volumes depositados em caixas publicas ou em escritorios de correio, sua distribucao e entrega, classificacao de correspondencia; aluguel de caixas postais; etc. Exclui-se deste grupo os servicos de poupanca postal e os outras atividades financeiras que utilizam os servicos postais (6613)	
	6412 Outras atividades de correio	Other postal services
	Nota: esta categoria compreende os servicos de malote e de entrega rapida; de coleta, transporte e entrega de documentos, cartas e pequenos volumes nao realizados pelo correio nacional	
642	Telecomunicacoes	Telecommunications
	Nota: esta clase compreende, em especial, a difusao e a transmissao de sons, imagens, dados e outros tipos de informacao por cabo, por estacoes de difusao e retransmissao - particularmente de sinais de radio e televisao - ou por satelite, assim como, as comunicacoes telefonicas (inclusive fax), telegraficas e por telex Exclusive a producao de programas de radio e televisao, combinadas ou nao com a difusao de tais programas (9214)	
	6420 Telecomunicacoes	Telecommunications

Source: IBGE (1994), *Listagem do Cadastro de atividades economicas*, Rio de Janeiro.

Appendix Table A2
Matching Procedures for Transport and Communications, Brazil and the USA, 1975

SIC code	Brazil	SIC code	USA
60	LAND TRANSPORT		
601	Rail transport		
6011	Rail passenger transport	401	Railroads, line-haul operating
6012	Other rail transport	404	Railway Express Service (REA)
602	Other Land Transport		
6021	Subway	4111	Subway operation
6022	Scheduled urban road passenger transport	4111	City and suburban bus line operation
6023	Scheduled rural road passenger transport	4131	Operation of bus lines, long distance
6024	Non-scheduled road passenger transport	4121	Taxicabs
		414	Passenger transportation charter service
		4151	School buses
		4119	Sightseeing buses, ambulance services, automobile rental with driver
6025	Road freight transport, general type of goods	421	Trucking, local and long distance
6026	Road transport of dangerous materials		
6027	Road transport of household goods (removals)		
6028	Miscellaneous passenger transport: streetcars, and trains used for touristic purposes	4111	Local and street railway operation, trolley coaches
603	Pipelines		
6030	Pipelines	461	Pipelines, except natural gas
61	Water transport		
611	Sea and coastal transport		
6111	Coastal transport	4422	Coastwise transportation
6112	Deep sea transport	441	Deap sea foreign transportation
		4421	Transportation to and between noncontiguous territories
		4423	Intercoastal transportation
612	Other types of water transport		
6121	Inland water transport	443	Great lakes-St. Lawrence seaway transportation
		444	Transportation on rivers and canals
6122	Urban and other types of water transport	445	Local water transportation
62	Air transport		
621	Scheduled air transport		
6210	Scheduled air transport	451	Air transportation, certificated carriers
622	Non-scheduled air transport		
6220	Non-scheduled air transport	455	Air transportation, noncertificated carriers
	Transport services and travel agencies		
631	Loading/unloading services and warehousing		
6311	Loading and unloading	422	Public warehousing
6312	Warehousing		

Appendix Table A2
Matching Procedures for Transport and Communications, Brazil and the USA, 1975

SIC code	Brazil	SIC code	USA
63	Miscellaneous transport services		
632	Miscellaneous transport services		
6321	Services incidental to land transport	4013	Switching and terminal establishments
		417	Terminal and service facilities for motor vehicle passenger transportation
		423	Terminal and joint terminal maintainance facilities for motor freight transportation
		4712	Customs clearing of freight
6322	Services incidental to water transport	4463	Marine cargo handling
		4469	Water transportation services, not elsewhere classified
6323	Services incidental to air transport	4582	Airports and flying fields
		4583	Airport terminal services
633	Travel agencies		
6330	Travel agencies	4722	Arangement of passenger transportation
6340	Miscellaneous transport services	471	Freight forwarding
		4723	Arrangement of transportation of freight and cargo
		4782	Inspection and weighing services
64	Postal services and telecommunications		
641	Postal services		
6411	National postal services	4311	US Postal service
6412	Other postal services		
642	Telecommunications		
6420	Telecommunications	481	Telephone communication
		482	Telegraph communication (wire or radio)
		489	Communication services, not elsewhere classified

Sources: Appendix Table A1 and Executive Office of the President, Office of Management and the Budget (1972), *Standard Industrial Classification*, Washington DC.

Appendix Table A3
Basic Brazilian Listing for Transport and Communications, 1975

		Unit	Quantity (million)	Gross value of output (million cruzeiros)	Total persons engaged
RAIL TRANSPORT					145,316
- Infrastructure		km	30,861		
- Rail passenger transport:	INTERIOR	passenger km	4,894	238	
		passengers	43		
		av. trip length	114		
	SUBURBIO	passenger km	5,727	157	
		passengers	249		
		av. trip length	23		
	TOTAL	passenger km	10,621	395	
		passengers	292		
		av. trip length	36		
- Rail freight transport		ton km	58,933	3,302	
		ton	126		
		av. freight haul	469		
RAOD PASSENGER TRANSPORT		passenger km	211,174		
Road passenger transport:	1974	passengers	8,990	11,157	
		no of vehicles	71,579		
		(micro)-onibus	61,091		
		no of seats	2,972,851		
		seats per bus	49		
	1976	passengers	13,920	11,523	
		no of vehicles	85,063		
		(micro)-onibus	72,759		
		no of seats	3,244,904		
		seats per bus	45		
	Average-1975	passengers	11,455	11,340	
		no of vehicles	78,321		
		(micro)-onibus	66,925		
		no of seats	3,108,878		
		seats per bus	46		
- Intercity bus passenger transport		passengers	4		
- International bus passenger transport		passenger km			
		passengers			
		av. trip length			
- SUBWAY of Sao Paolo		network, km	17		
		no of vehicle	96		
		veh km	1		
		journeys	22		
ROAD FREIGHT TRANSPORT		ton km	204,824		
Road freight transport:	1974	tons	97	12,558	
		no of vehicles	37,251		
	1976	tons	151	14,725	
		no of vehicles	56,781		
	Average-1975	tons	124	13,641	
		no of vehicles	47,016		

Appendix Table A3 (cont.)
Basic Brazilian Listing for Transport and Communications, 1975

	Unit	Quantity (million)	Gross value of output (million cruzeiros)	Total persons engaged
- International road freight transport	ton km	496		
	ton	0		
	av. freight haul	1,861		
PIPELINES				
- Oil transport	ton	50		
	ton km	6,904		
	av. haul	137		
AIR TRANSPORT				
- Operating revenues: domestic			3,066	
international			2,684	
- Passengers: domestic	seat km	9,480	3,724	
	passenger km	5,106		
	passengers	6		
	av. trip length	831		
international	seat km	7,875	1,178	
	passenger km	5,276		
	passengers	1		
	av. trip length	3,914		
TOTAL	seat km	17,355	6,342	
	passenger km	10,382		
	passengers	7		
	av. trip length	1,385		
- Freight: domestic	offered ton km	1,079	419	
	ton km	521		
international	offered ton km	1,398	429	
	ton km	847		
TOTAL	offered ton km	2,477	769	
	ton km	1,368		
- Passengers and freight: domestic	ton km	980		
international	ton km	895		
TOTAL	ton km	1,875		
- Airports: INTERNATIONAL TRAFFIC	passengers handled	2		
	tons of freight	0		
	tons of mail	3		
WATER TRANSPORT				
- Ports: COASTAL TRANSPORT - unloaded	ton	22		
loaded	ton	23		
SEA TRANSPORT - unloaded	ton	58		
loaded	ton	85		
- INLAND WATER TRANSPORT - passengers	passengers	0	6	
freight	ton	3	146	

Appendix Table A3 (cont.)
Basic Brazilian Listing for Transport and Communications, 1975

	Unit	Quantity (million)	Gross value of output (million cruzeiros)	Total persons engaged
- COASTAL FREIGHT TRANSPORT - freight	ton km	31,740	1,154	
	ton	17		
	av. freight haul	1,894		
	ton	22		
	ton	23		
- passengers	passsenger km	10		
- SEA TRANSPORT - import	ton	52	1,199	
export	ton	82	873	
	ton	58		
	ton	85		
COMMUNICATIONS				163,093
Postal services: - items of mail handled	number	1,246	1,235	84,710
- telegrams transmitted	number	17	257	
Telecommunications: telephones 1974	number	3	8,260	78,383
1976	number	4	10,479	90,254
average		3	9,369	84,319

Source: IBGE (various issues), *Anuario Estatistico do Brasil*; Ministerio do Transportes (1982), *Anuário Estatístico dos Transportes*, Rio de Janeiro.

a) Frete bruto gerado pelas principais empresas.

Appendix Table A4
Basic US Listing for Transport and Communications, 1975

SIC code		Unit	Quantity (million)	Gross value of output (million US$)	Number of Persons Engaged
4111	City and suburban bus line operations	passengers	5,084	1,438	
		vehicle-miles	2,455		
		No of vehicles	50,811		
4131	Operation of bus lines, long distance				
	- Intercity bus lines, total (Stat. Abstract)	vehicle-miles	1,812	1,172	47,000
		passengers	351		
		passenger-km	40,869		
	- Intercity bus lines, Class I (Stat. Abstract)	vehicle-miles	835	651	31,000
		passengers	147		
	- Intercity bus lines, total (Nat. Transportation Statistics)	passengers	351	1,172	46,600
		passenger-km	40,869		
	- Intercity bus lines, Class I (Nat. Transportation Statistics)	vehicle-miles		955	35,140
		passengers	152		
		passenger-km	21,303		
4111	Passenger transportatation: regular route	No data			
4151	School buses	vehicle-miles	2,500	2,174	
4119	Sightseeing buses	No data			
4212	Furniture moving, local without storage	vehicle-miles	688	866	4,000
4213	Long distance trucking (removals)	tons	3		
4214	Furniture moving, local with storage	No of vehicles	18,000		
		km per truck	61,500		
421	Trucking, local and long distance:				
	- Intercity	ton-km	730,486	47,400	
	- Class I intercity motor carriers of property:				
	- Common Carriers, general freight	vehicle-miles	6,246	10,511	
		tons	191		
		No of vehicles	78,000		
		km per truck	128,844		
	- Common Carriers, other than general freight	vehicle-miles	4,776	3,717	
		tons	264		
		No of vehicles	69,000		
		km per truck	111,371		
	- Contract Carriers, other than general freight	vehicle-miles	454	411	
		tons	21		
		No of vehicles	8,000		
		km per truck	91,311		
401	Railroads, line-haul operating				
	- Class I railroads: freight	tons	1,395	15,390)	
		ton-km	1,213,591	)	
					488
	passengers	passengers	269	297)	
		passenger-km	15,985	)	
404	Railway Express Service (REA)	No data			
4111	Local and street railway operation, trolley coaches	vehicle-miles	40	32	
		passengers	231		
4111	Subway operation	vehicle-miles	423	517	
		passengers	1,673		

Appendix Table A4 (cont.)
Basic US Listing for Transport and Communications, 1975

SIC code		Unit	Quantity (million)	Gross value of output (million US$)	Number of Persons Engaged
461	Pipe lines, except natural gas	Ton-miles	507,000	2,220	
		Tons	880		
441	Deap sea foreign transportation	Tons	749	4,928	
4421	Transportation to and between noncontiguous territories				
4423	Intercoastal transportation				
4422	Coastwise transportation	ton-miles	315,846	1,136	
		tons	232		
		av. haul, km	2,191		
443	Great lakes-St. Lawrence seaway transportation	ton-miles	68,517	348	
		tons	129		
		av. haul, km	853		
444	Transportation on rivers and canals, small lakes	ton-miles	180,399	1,283	
		tons	504		
		av. haul, km	576		
445	Local water transportation (lighterage, towing and tugboat services, ferries)	ton-miles	1,222	526	
		tons	78		
		av. haul, km	26		
4463	Marine cargo handling	No data			
446	Intercity water transport of passengers	passenger-km	6,436	16	
4469	Water transportation services, nec	No data			
451	Air transportation, certificated carriers:	STAT. ABSTRACT:		14,974	296,613
	- Domestic: passengers	passenger-km	211,905	10,290	
		passengers	189		
	express, freight and mail	ton-km	5,022	949	
	- International: passengers	passenger-km	50,040	2,435	
		passengers	16		
	express, freight and mail	ton-km	3,624	478	
		NAT. TRANSP. STAT.:			
	- Domestic: passengers	passenger-km	218,823		
		passengers	191		
	express, freight and mail	ton-km	5,582		
452	- International: passengers	passenger-km	60,055		
		passengers	18		
	express, freight and mail	ton-km	4,395		
4583	Air transportation, noncertificated carriers	No data			
4784	Airport terminal services	No data			

Appendix Table A4 (cont.)
Basic US Listing for Transport and Communications, 1975

SIC code		Unit	Quantity (million)	Gross value of output (million US$)	Number of Persons Engaged
4582	Fixed facilities for handling motor vehicle transportation (bridges, toll roads)	No data			
	Airports and flying fields	passengers	13		
4464	- arrivals	passengers	12		
4469	- departures				
	Canal operation				
423	Water transportation services	No data			
422	Freight trucking terminals	No data			
4712	Public warehousing	No data			
4712	Arrangement of passenger transportation	No data			
4782	Customs clearing of freight	No data			
4742	Weighing services connected with transportation	No data			
	Rental of railroad cars	No data			
	COMMUNICATION:				
481	Telephone communication	Telephones	130	31,300	840,000
		No of calls:	228,917		
		domestic	228,855		
		international	62		
482	Telegraph communication:				
	- Domestic telegraph	messages	42	197	
	- Overseas telegraph	messages	26	217	
489	Communication services, nes				
4311	US Postal service:				702,000
	- Domestic mail	pieces	88,334	11,200	
		weight (lb.)	11,824		
	- Foreign mail	pieces	932	390	
		weight (lb.)	201		

Sources: Department of Commerce, *Statistical Abstract of the United States*, Washington DC, various issues; Department of Transportation, Bureau of Transportation Statistics, *National Transportation Statistics*, Washington DC, various issues.

Table A5

Matching of Product Items, USA - Brazil, Transport and Communications

SIC code	US census listing	Unit	US quantity (million)	US value (million US$)	US unit value (US$) per 1000	US Quantity valued at Brazilian unit values	Unit value ratio cruz./US$ US quantity weights	SIC code	Brazilian listing	Unit	Brazil quantity (million)	Brazil value (million cruz.)	Brazil unit value (cruz.) per 1000	Brazil quantity valued at US unit values	Unit value ratio cruz./US$ Brazilian quantity weights
RAIL TRANSPORT								RAIL TRANSPORT							
401	Railroads, line-haul operating - Freight transport	ton	1,265	15,390	12,162	33,687	2.19	7131	Railroads: - Freight	ton	126	3,345	26,623	1,528	2.19
		ton-km	1,213,591	15,390	13	68,885	4.48			ton-km	58,933	3,345	57	747	4.48
		output index	1,471	15,390	10	49,192	3.20			output index	100	3,345	33	1,047	3.20
	- Passenger transport	passengers	269	297	1,102	1,491	5.02		- Passengers	passengers	43	238	5,535	47	5.02
		passenger-km	15,985	297	19	778	2.62			passenger km	4,894	238	49	91	2.62
		output index	128	297	2	1,073	3.61			output index	47.149	395	8	109	3.61
	MATCHED ITEMS: tons/pass. as output measures		613	15,687		35,178	2.24					3,583		1,576	2.27
	ton km and pass. km as output measures			15,687		69,663	4.44					3,583		838	4.27
	output index as measure			15,687		50,265	3.20					3,740		1,156	3.24
	ROAD PASSENGER TRANSPORTATION														
4111	City and suburban bus line operations	passengers	5,084	1,438	283										
4131	Operations of bus lines, long distance	passengers	351	1,126	3,208										
	TOTAL MATCHED	passengers	5,435	2,564	472	5,380	2.10		- BUS passenger transport	passengers	11,455	11,340	990	5,404	2.10
	ROAD PASSENGER TRANSPORTATION: Quality adjusted (see text)														
4111	City and suburban bus line operations	passengers	5,084	1,438	283										
4131	Operations of bus lines, long distance - Intercity bus lines, total	passengers	351	1,126	3,208										
	TOTAL MATCHED		5,435	2,564	472	7,865	3.07		- BUS passenger transport	passengers	7,837	11,340	1,447	3,697	3.07
ROAD FREIGHT TRANSPORT								ROAD FREIGHT TRANSPORT							
	TOTAL	index	1,375	47,400	34,472	187,571	3.96		Road freight transport	ton	100	13,641	136,414	3,447	3.96
	TOTAL ROAD TRANSPORT			49,964		195,436	3.91					24,981		7,144	3.50

Table A5 (cont.)

Matching of Product Items, USA - Brazil, Transport and Communications

SIC code	US census listing	Unit	US quantity (million)	US value (million US$)	US unit value (US$) per 1000	US Quantity valued at Brazilian unit values	Unit value ratio cruz./US$ US quantity weights	SIC code	Brazilian listing	Unit	Brazil quantity (million)	Brazil value (million cruz.)	Brazil unit value (cruz.) per 1000	Brazil quantity valued at US unit values	Unit value ratio cruz./US$ Brazilian quantity weights
AIR TRANSPORT								AIR TRANSPORT							
	- Domestic: passengers	index	3,872	10,290	2,658	205,975	20.02		- Domestic: passengers	index	70	3,724	53,200	186	20.02
	- International: passengers	index	996	2435	2,444	16,765	6.88		- International: passengers	index	70	1,178	16,826	171	6.88
	- Domestic: freight	tonne km	5,022	949	189	4,043	4.26		- Domestic: freight	tonne km	521	419	805	98	4.26
	- International: freight	tonne km	3,624	478	132	1,835	3.84		- International: freight	tonne km	847	429	506	112	3.84
	TOTAL			14,152		228,618	16.15		TOTAL			5,750		567	10.14
WATER TRANSPORT								WATER TRANSPORT							
4422	Sea and coastwise transportation		964	6,590	6,836	66,410	10.08		Sea and coastwise transportation	ton	17	1,154	68,890	115	10.08
443	Great lakes-St. Lawrence seaway transportation		117	348											
444	Transportation on rivers and canals, small lakes		457	1,283											
445	Local water transportation (lighterage, towing and tugboat services, ferries)		71	526											
	TOTAL		645	2,157	3,345	35,270	16.35		Inland freight transport	ton	3	146	54,693	9	16.35
	TOTAL MATCHED			8,747		101,680	11.62					1,300		123	10.53
COMMUNICATIONS								COMMUNICATIONS							
4311	US Postal service	pieces of domestic mail	88,334	9,625	109	87,505	9.09		Postal services	pieces of domestic mail	1,246	1,235	991	136	9.09
482	Telegraph communication	messages transmitted	68	413	6,074	1,006	2.44		Telegraph communication	messages transmitted	17	257	14,789	106	2.44
481	Telephone services	telephones	130	31,300	240,769	352,211	11.25		Telephone services	telephones	3	9,369	2,709,316	833	11.25
	TOTAL			41,338		440,722	10.66					10,861		1,074	10.11

Sources: Table A3 and A4.

Appendix Table A6
GDP at Constant Prices in Transport and Communications, Brazil and the USA, 1950-90

	Brazil: GDP at Constant Prices (million 1982 cruzeiros)				USA: GDP at Constant Prices (million 1982 US$)		
	Transport	Communi-cations	Transport & Communi-cations		Transport	Communi-cations	Transport & Communi-cations
1950			162	1950	61,395	9,731	71,125
1951			177	1951	66,615	10,838	77,452
1952			196	1952	64,448	11,482	75,930
1953			210	1953	64,010	12,585	76,595
1954			232	1954	59,575	12,909	72,484
1955			251	1955	64,691	14,172	78,864
1956			261	1956	67,021	15,007	82,028
1957			274	1957	66,399	16,112	82,511
1958			295	1958	61,376	16,693	78,069
1959			314	1959	64,386	17,853	82,239
1960			344	1960	65,144	18,925	84,069
1961			403	1961	64,707	19,774	84,481
1962			416	1962	67,317	21,195	88,513
1963			451	1963	70,921	22,644	93,565
1964			487	1964	73,009	24,042	97,050
1965			494	1965	79,213	26,074	105,286
1966			503	1966	85,812	28,465	114,277
1967			536	1967	85,197	30,630	115,826
1968			578	1968	88,892	32,931	121,824
1969			629	1969	92,202	36,351	128,552
1970			703	1970	90,961	39,758	130,719
1971	738	71	808	1971	90,555	41,810	132,365
1972	846	77	924	1972	97,654	45,713	143,367
1973	912	87	999	1973	104,047	49,083	153,130
1974	1,093	99	1,192	1974	105,175	51,463	156,639
1975	1,252	129	1,381	1975	97,800	53,657	151,457
1976	1,377	166	1,543	1976	105,459	56,499	161,958
1977	1,558	203	1,761	1977	111,700	60,100	171,800
1978	1,651	259	1,910	1978	119,800	66,400	186,200
1979	1,791	313	2,104	1979	124,400	72,000	196,400
1980	1,968	397	2,365	1980	117,100	79,500	196,600
1981	2,116	476	2,592	1981	110,600	84,000	194,600
1982	2,079	537	2,616	1982	110,759	85,633	196,392
1983	2,033	596	2,629	1983	124,000	91,700	215,700
1984	2,121	674	2,796	1984	132,300	89,500	221,800
1985	2,262	796	3,058	1985	132,400	89,800	222,200
1986	2,516	952	3,468	1986	138,000	92,500	230,500
1987	2,631	1,039	3,670	1987	149,800	102,100	251,900
1988	2,742	1,149	3,891	1988	147,249	108,101	255,351
1989	2,848	1,369	4,217	1989	151,762	108,581	260,343
1990	2,826	1,492	4,318	1990	157,844	112,342	270,186

Sources: Brazil: GDP for 1950-80 was taken from Gusmão Veloso (1987); linked to 1980-90 figures from *Contas Consolidadas para a Naçao 1980-1991* (IBGE, 1992); USA: 1950-77 GDP figures from *The National Income and Product Accounts of the United States, 1929-82* (BEA, 1986), 1977-87 data from *Survey of Current Business* (BEA, January and April 1991), and for the 1988-90 period from BEA *Survey of Current Business*, May 1993.

Appendix Table A7
Employment in Transport and Communications, Brazil and the USA, 1950-90

	Brazil: Persons Engaged in Transport and Communications (000s)				USA: Persons Engaged in Transport and Communications (000s)		
	Transport	Communi-cations	Transport & Communi-cations		Transport	Communi-cations	Transport & Communi-cations
1950	636	54	689	1950	2,978	730	3,708
1951	663	55	719	1951	3,144	762	3,906
1952	692	58	749	1952	3,122	791	3,913
1953	722	60	781	1953	3,126	823	3,949
1954	753	62	815	1954	2,905	824	3,729
1955	785	64	850	1955	2,941	840	3,781
1956	819	67	886	1956	2,989	890	3,879
1957	855	69	924	1957	2,953	909	3,862
1958	892	72	963	1958	2,719	859	3,578
1959	930	74	1,004	1959	2,747	835	3,582
1960	970	77	1,047	1960	2,746	841	3,587
1961	983	81	1,064	1961	2,651	830	3,481
1962	995	85	1,080	1962	2,656	826	3,482
1963	1,007	90	1,097	1963	2,650	828	3,478
1964	1,020	94	1,114	1964	2,677	850	3,527
1965	1,033	99	1,132	1965	2,715	882	3,597
1966	1,046	104	1,150	1966	2,797	930	3,727
1967	1,059	109	1,169	1967	2,849	969	3,818
1968	1,073	115	1,187	1968	2,890	980	3,870
1969	1,086	121	1,207	1969	2,919	1,054	3,973
1970	1,100	127	1,227	1970	2,888	1,125	4,013
1971			1,269	1971	2,850	1,128	3,978
1972			1,312	1972	2,872	1,147	4,019
1973			1,356	1973	2,963	1,179	4,142
1974			1,403	1974	3,016	1,198	4,214
1975			1,451	1975	2,887	1,180	4,067
1976			1,500	1976	2,910	1,170	4,080
1977			1,538	1977	3,009	1,193	4,202
1978			1,575	1978	3,175	1,244	4,419
1979			1,603	1979	3,310	1,316	4,626
1980			1,800	1980	3,268	1,358	4,626
1981			1,768	1981	3,252	1,399	4,651
1982			1,831	1982	3,130	1,431	4,561
1983			1,778	1983	3,115	1,371	4,486
1984			1,818	1984	3,283	1,356	4,639
1985			1,916	1985	3,371	1,332	4,703
1986			1,989	1986	3,411	1,301	4,712
1987			2,161	1987	3,559	1,293	4,852
1988			2,210	1988	3,707	1,291	4,998
1989			2,274	1989	3,812	1,274	5,086
1990			2,440	1990	3,893	1,328	5,221

Sources: Brazil: employment in 1950, 1960 and 1970 from IBGE (various issues), *Censo Demografico*; intermediate years were interpolated using average annual compound growth rates; 1971-75 employment was estimated by interpolation of 1970 population census estimate and 1976 entry in PNAD; The 1950-75 estimates were linked to the 1976-1990 figures from *Pesquisa Nacional por Amostra de Domicilios* (PNAD) (IBGE, various years); USA: 1950-82 from BEA (1986), *The National Income and Product Accounts of the United States, 1929-82*, Washington DC, 1982-90 from BEA (1992), *The National Income and Product Accounts of the United States, 1959-1988*, Washington DC; 1989-90 from BEA, *Survey of Current Business*, various issues.